Sherwood Engineering HF Test Results

Model TS-890S Serial # B8830060 Test Dates: 10/15/2018 – 10/17/2018

IF BW 2400 –6 / -60, Hz 2530 / 3730	Ultimate	114	dB
IF BW 500 –6 /-60, Hz /	Ultimate	>118	dB

Front End Selectivity (A – F)	Half Octave	B
First IF rejection +/- kHz	77	dB

Dynamic Range with radio, no preamp

Dynamic Range 20 kHz	106	dB
Dynamic Range 10 kHz	106	dB
Dynamic Range 5 kHz	106	dB
Dynamic Range 2 kHz	105	dB*

Note: Phase noise caused no degradation of the dynamic range measurement.
* A slight variation in passive IMD in the roofing filter was noted at 2 kHz spacing

Blocking or ADC overload above noise floor

1uV signal @ 100 kHz, AGC On,	>151	dB

Reciprocal Mixing Dynamic Range (RMDR)

Spacing kHz	10m#	dB	20m#	dB	40m*	dB	40m#	dB	80m#	dB
2.0	114	dB	119	dB	127	dB	123	dB	122	dB
2.5	116	dB	121	dB	128	dB	125	dB	124	dB
5	121	dB	124	dB	129	dB	126	dB	125	dB
10	123	dB	125	dB	130	dB	127	dB	126	dB
15	124	dB	125	dB	131	dB	127	dB	127	dB
20	124	dB	126	dB	131	dB	128	dB	127	dB
25	124	dB	126	dB	131	dB	128	dB	128	dB
30	124	dB	126	dB	131	dB	128	dB	128	dB
40	124	dB	126	dB	131	dB	128	dB	128	dB
50	124	dB	126	dB	131	dB	128	dB	128	dB
75	124	dB	126	dB	131	dB	128	dB	128	dB
100	124	dB	126	dB	131	dB	128	dB	128	dB

Measured with HP 8642A at +20 dBm and external attenuation
* Measured with Wenzel 7.00 MHz crystal oscillator and external attenuation

See addendum on 20m RMDR measurement.

Phase noise dBc/Hz per band	20m#	40m*
Phase noise (normalized) at 2.0 kHz spacing:	146	154
Phase noise (normalized) at 2.5 kHz spacing:	148	155
Phase noise (normalized) at 5 kHz spacing:	151	156
Phase noise (normalized) at 10 kHz spacing:	152	157
Phase noise (normalized) at 15 kHz spacing:	152	158
Phase noise (normalized) at 20 kHz spacing:	153	158
Phase noise (normalized) at 30 kHz spacing:	153	158
Phase noise (normalized) at 40 kHz spacing:	153	158
Phase noise (normalized) at 50 kHz spacing:	153	158
Phase noise (normalized) at 75 kHz spacing:	153	158
Phase noise (normalized) at 100 kHz spacing:	153	158

#Measurements using HP 8642A at +20 dBm and external attenuation
*Measurements using Wenzel 7.00 MHz crystal oscillator and external attenuation

Noise floor, SSB bandwidth 14 MHz, no preamp	-125	dBm
Noise floor, SSB bandwidth 14 MHz, Preamp 1 On	-134	dBm
Noise floor, SSB bandwidth 14 MHz, Preamp 2 On	-137	dBm
Sensitivity SSB at 14 MHz, no preamp	0.39	uV
Sensitivity SSB at 14 MHz, Preamp 1 On	0.13	uV
Sensitivity SSB at 14 MHz, Preamp 2 On	0.10	uV
Noise floor, 500 Hz, 28.5 MHz, no preamp	-130	dBm
Noise floor, 500 Hz, 3.5 MHz, no preamp	-131	dBm
Noise floor, 500 Hz, 1.8 MHz, no preamp	-131	dBm
Noise floor, 250 Hz, 14.2 MHz, no preamp	-134	dBm
Noise floor, 500 Hz, 14.2 MHz, no preamp	-131	dBm
Noise floor, 500 Hz, 14.2 MHz, Preamp 1 On	-140	dBm
Noise floor, 500 Hz, 14.2 MHz, Preamp 2 On	-143	dBm
Noise floor, SSB, 50.125 MHz, no preamp	-122	dBm
Noise floor, SSB, 50.125 MHz, Preamp 1	-133	dBm
Noise floor, SSB, 50.125 MHz, Preamp 2	-135	dBm
Sensitivity, SSB, 50.125 MHz, no preamp	0.54	uV
Sensitivity, SSB, 50.125 MHz, Preamp 1	0.16	uV
Sensitivity, SSB, 50.125 MHz, Preamp 2	0.12	uV
Noise floor, 500 Hz, 50.125 MHz, no preamp	-129	dBm
Noise floor, 500 Hz, 50.125 MHz, Preamp 1 On	-139	dBm
Noise floor, 500 Hz, 50.125 MHz, Preamp 2 On	-141	dBm

Signal for S9, no preamp	-69	dBm	79	uV
Signal for S9, Preamp 1	-81	dBm	21	uV
Signal for S9, Preamp 2	-92	dBm	6	uV

Gain of preamp(s)		
Preamp 1	12	dB
Preamp 2	23	dB

AGC threshold at 3 dB, no preamp	2.1	uV
AGC threshold at 3 dB, Preamp 1 On	0.53	uV
AGC threshold at 3 dB, Preamp 2 On	0.14	uV

Notes:

All tests on SSB were made with the standard 2700-Hz roofing filter, and on CW with the standard 500-Hz roofing filter.

Each S unit is 3.2 dB. Above S9 the S meter in dB tracks perfectly from S9 to S9+60.

Transmit odd-order IMD measurements will be made at a later date.

The 890S was used during CQWW SSB and ARRL 160 meter CW contests.
"Shootout" report currently available at:

http://www.dj0ip.de/sherwood-forest/sherwood-s-shootouts/kenwood-890s-vs-icom-7610/

Addendum: 20m RMDR using a 20m crystal bandpass phase-noise cleanup filter on the HP 8642A synthesizer.

Spacing	without filter	with filter
5 kHz	124 dB	126 dB
10 kHz	125 dB	128 dB
20 kHz	126 dB	129 dB
50 kHz	126 dB	129 dB

Note: The TS-890S has the highest RMDR I have ever measured.
The Sherwood lab has now been upgraded to include four low noise Wenzel crystal oscillators to make RMDR measurements on state-of-the-art transceivers on 40, 20, 12, 10 and 6 meters.

Kenwood TS-890S RMDR and phase noise measurements at 50 MHz.

Preamp OFF, 500 Hz BW, noise floor -128 dBm
Wenzel test oscillator: 12 Volt model 500-07044G, output +8 dBm
Level measurements made with Boonton 9200A digital RF voltmeter

Offset kHz	Att	dBm	RMDR	dBc/Hz
2.0	16	-8	120	-147
2.5	15	-7	121	-148
5.0	14	-6	122	-149
10	13	-5	123	-150
20	12	-4	124	-151
30	11	-3	125	-152
40	11	-3	125	-152
50	11	-3	125	-152

Transmit composite noise (phase noise and AM noise) measurements
Icom IC-7610, Kenwood TS-890S & Yaesu FTdx-3000 (for comparison purposes)

Measurements made with a Perseus FFT receiver on 14.200 MHz.
Attenuation: Bird 30-dB 500-watt attenuator followed by a 20-dB 2-watt attenuator, coax cable, and finally a 3 dB attenuator at the antenna input of the Perseus.

Note: Both the Icom and Kenwood transceivers have good value of transmitted noise compared to some other examples. As is always the case, noise increases when less than full output power is selected. Some linear amps only require 35 to 50 watts of drive to produce full output, thus the transmitted noise will be higher in that case. The ARRL generally publishes transmit noise at both full output and at 35 watts.

7610 offset	100 watts	35 watts
5 kHz	-126 dBc/Hz	-121 dBc/Nz
10 kHz	-127 dBc/Hz	-122 dBc/Hz
20 kHz	-129 dBc/Hz	-124 dBc/Hz

890S offset	100 watts	35 watts
5 kHz	-118 dBc/Hz	-112 dBc/Hz
10 kHz	-120 dBc/Hz	-113 dBc/Hz
20 kHz	-129 dBc/Hz	-122 dBc/Hz

FTdx-3000*	100 watts	30 watts
5 kHz	-116 dBc/Hz	-115 dBc/Hz
10 kHz	-120 dBc/Hz	-117 dBc/Hz
20 kHz	-121 dBc/Hz	-117 dBc/Hz

* FTdx-3000 data by N0QO

Rev. G